

Towards Fuzzy Analytical Hierarchy Process Model for Performance Evaluation of Healthcare Sector Services

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Abstract

All service providers strive to attain superior service quality (SQ), since the demand for provision of high quality customer focused services is constantly rising. In the healthcare sector, it becomes of utmost importance to understand consumer expectations and their needs to effectively remain competitive in the market. Increase in the per capita income of clients has made them increase their aspiration level to demand enhanced quality services. Currently, hospitals in Nairobi City County (NCC) in Kenya, do not offer services to patients based on their aspirations and in the process, they lose clients. There is need for hospital administrators to determine how patients perceive healthcare quality service, and employ techniques that match their expectations. This is probable by using patients to evaluate their services based on identified criteria. Human evaluations are normally imprecise thus uncertainty aspects should be integrated in the evaluation process. Techniques employed should be able to handle the subjective nature of human evaluators. Fuzzy analytic hierarchy process (FAHP) model has been designed to analyze the service quality in the healthcare sector based on SERVQUAL dimensions. The model is capable of handling the uncertainty and vagueness involved in the mapping of one's preference to an exact number or ratio. It has been used to measure the SQ of four hospitals from NCC by computing the priority of each of the dimensions of healthcare SQ

attributes. The priority is then used for ranking the best hospital from the patient's perspective. Hospital managers can use the results of this assessment as a basis of employing strategies that would ensure they provide quality services to patients.

Keywords

Fuzzy analytical hierarchy process SERVQUAL Service quality Performance Healthcare

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References

1. The Constitution of Kenya (2010).
<https://www.wipo.int/edocs/lexdocs/laws/en/ke/ke019en.pdf>
(<https://www.wipo.int/edocs/lexdocs/laws/en/ke/ke019en.pdf>). Accessed Aug 2018
2. Donabedian, A.: Quality assessment and assurance: unity of purpose, diversity of means. *Inquiry* **25**(1), 175–192 (1988)
[Google Scholar](#) (http://scholar.google.com/scholar_lookup?title=Quality%20assessment%20and%20assurance%3A%20unity%20of%20purpose%20diversity%20of%20means&author=A.%20Donabedian&journal=Inquiry&volume=25&issue=1&pages=175-192&publication_year=1988)
3. Marshall, G.N., Ron, D.H., Rebecca, M.: Health status and satisfaction with healthcare: results from the medical outcomes study. *J. Consult. Clin. Psychol.* **64**(2), 380–390 (1996)
[CrossRef](#) (<https://doi.org/10.1037/0022-006X.64.2.380>)
[Google Scholar](#) (http://scholar.google.com/scholar_lookup?title=Health%20status%20and%20satisfaction%20with%20healthcare%3A%20results%20from%20the%20medical%20outcomes%20study&author=GN.%20Marshall&author=DH.%20Ron&author=M.%20Rebecca&journal=J.%20Consult.%20Clin.%20Psychol.&volume=64&issue=2&pages=380-390&publication_year=1996)
4. Li, L., Benton, W.C.: Hospital capacity management decisions: emphasis on cost control and quality enhancement. *Eur. J. Oper. Res.* **146**(3), 596–614 (2003)
[zbMATH](#) (<http://www.emis.de/MATH-item?1037.90541>)
[CrossRef](#) ([https://doi.org/10.1016/S0377-2217\(02\)00225-4](https://doi.org/10.1016/S0377-2217(02)00225-4))
[Google Scholar](#) (http://scholar.google.com/scholar_lookup?title=Hospital%20capacity%20management%20decisions%3A%20emphasis%20on%20cost%20control%20and%20quality%20enhancement&author=L.%20Li&author=WC.%20Benton&journal=Eur.%20J.%20Oper.%20Res.&volume=146&issue=3&pages=596-614&publication_year=2003)
5. Headley, D.E., Miller, S.J.: Measuring service quality and its relationship to future consumer behaviour. *Mark. Health Serv.* **13**(4), 32–42 (1993)
[Google Scholar](#) (http://scholar.google.com/scholar_lookup?title=Measuring%20service%20quality%20and%20its%20relationship%20to%20future%20consumer%20behaviour&author=DE.%20Headley&author=SJ.%20Mil)

ler&journal=Mark.%20Health%20Serv.&volume=13&issue=4&pages=32-42&publication_year=1993)

6. Sgroi, F., Di Trapani, A.M., Testa, R., Tudisca, S.: Strategy to increase the farm competitiveness. *Am. J. Agric. Biol. Sci.* **9**, 394–400 (2014)
CrossRef (<https://doi.org/10.3844/ajabssp.2014.394.400>)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Strategy%20to%20increase%20the%20farm%20competitiveness&author=F.%20Sgroi&author=AM.%20Trapani&author=R.%20Testa&author=S.%20Tudisca&journal=Am.%20J.%20Agric.%20Biol.%20Sci.&volume=9&pages=394-400&publication_year=2014)
7. Squatrito, R., Sgroi, F., Tudisca, S., Di Trapani, A.M., Testa, R.: Post feed-in scheme photovoltaic system feasibility evaluation in Italy: sicilian case studies. *Energies* **7**, 7147–7165 (2014)
CrossRef (<https://doi.org/10.3390/en7117147>)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Post%20feed-in%20scheme%20photovoltaic%20system%20feasibility%20evaluation%20in%20Italy%3A%20sicilian%20case%20studies&author=R.%20Squatrito&author=F.%20Sgroi&author=S.%20Tudisca&author=AM.%20Trapani&author=R.%20Testa&journal=Energies&volume=7&pages=7147-7165&publication_year=2014)
8. Choi, K.S., Cho, W.H., Lee, S., Lee, H., Kim, C.: The relationships among quality, value, satisfaction and behavioral intention in health care provider choice: a South Korean study. *J. Bus. Res.* **57**(8), 913–921 (2004)
CrossRef ([https://doi.org/10.1016/S0148-2963\(02\)00293-X](https://doi.org/10.1016/S0148-2963(02)00293-X))
Google Scholar (http://scholar.google.com/scholar_lookup?title=The%20relationships%20among%20quality%2C%20value%2C%20satisfaction%20and%20behavioral%20intention%20in%20health%20care%20provider%20choice%3A%20a%20South%20Korean%20study&author=KS.%20Choi&author=WH.%20Cho&author=S.%20Lee&author=H.%20Lee&author=C.%20Kim&journal=J.%20Bus.%20Res.&volume=57&issue=8&pages=913-921&publication_year=2004)
9. Lee, M.A., Yom, Y.H.: A comparative study of patients' and nurses' perceptions of the quality of nursing services, satisfaction and intent to revisit the hospital: a questionnaire survey. *Int. J. Nurs. Stud.* **44**, 545–555 (2007)
CrossRef (<https://doi.org/10.1016/j.ijnurstu.2006.03.006>)
Google Scholar (http://scholar.google.com/scholar_lookup?title=A%20comparative%20study%20of%20patients%20and%20nurses%20perceptions%20of%20the%20quality%20of%20nursing%20services%2C%20satisfaction%20and%20intent%20to%20revisit%20the%20hospital%3A%20a%20questionnaire%20survey&author=MA.%20Lee&author=YH.%20Yom&journal=Int.%20J.%20Nurs.%20Stud.&volume=44&pages=545-555&publication_year=2007)
10. Hulton, L.A., Matthews, Z., Stones, R.W.: Applying a framework for assessing the quality of maternal health services in urban India. *Soc. Sci. Med.* **64**(10), 2083–2095 (2007)
CrossRef (<https://doi.org/10.1016/j.socscimed.2007.01.019>)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Applying%20a%20framework%20for%20assessing%20the%20quality%20of%20maternal%20health%20services%20in%20urban%20India&author=LA.%20

Hulton&author=Z.%20Matthews&author=RW.%20Stones&journal=Soc.%20Sci.%20Med.&volume=64&issue=10&pages=2083-2095&publication_year=2007)

11. Brown, T.J., Churchill, G.A.: Peter, J: Improving the measurement of service quality. *J. Retail.* **69**(1), 127–139 (1993)
[CrossRef](https://doi.org/10.1016/S0022-4359(05)80006-5) (https://doi.org/10.1016/S0022-4359(05)80006-5)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Peter%2C%20J%3A%20Improving%20the%20measurement%20of%20service%20quality&author=T.J.%20Brown&author=GA.%20Churchill&journal=J.%20Retail.&volume=69&issue=1&pages=127-139&publication_year=1993) (http://scholar.google.com/scholar_lookup?title=Peter%2C%20J%3A%20Improving%20the%20measurement%20of%20service%20quality&author=T.J.%20Brown&author=GA.%20Churchill&journal=J.%20Retail.&volume=69&issue=1&pages=127-139&publication_year=1993)
12. Kaplan, R.S., Norton, D.P.: The balanced scorecard: measures that drive performance. *Harv. Bus. Rev.* 71–79 (1992)
[Google Scholar](https://scholar.google.com/scholar?q=Kaplan%2C%20R.S.%2C%20Norton%2C%20D.P.%3A%20The%20balanced%20scorecard%3A%20measures%20that%20drive%20performance.%20Harv.%20Bus.%20Rev.%2071%E2%80%9379%20%281992%29) (https://scholar.google.com/scholar?q=Kaplan%2C%20R.S.%2C%20Norton%2C%20D.P.%3A%20The%20balanced%20scorecard%3A%20measures%20that%20drive%20performance.%20Harv.%20Bus.%20Rev.%2071%E2%80%9379%20%281992%29)
13. Schvaneveldt, S.J., Enkawa, T., Miyakawa, M.: Consumer evaluation perspectives of service quality: evaluation factors and two-way model of quality. *Total Qual. Manag.* **2**, 149–161 (1991)
[CrossRef](https://doi.org/10.1080/09544129100000016) (https://doi.org/10.1080/09544129100000016)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Consumer%20evaluation%20perspectives%20of%20service%20quality%3A%20evaluation%20factors%20and%20two-way%20model%20of%20quality&author=SJ.%20Schvaneveldt&author=T.%20Enkawa&author=M.%20Miyakawa&journal=Total%20Qual.%20Manag.&volume=2&pages=149-161&publication_year=1991) (http://scholar.google.com/scholar_lookup?title=Consumer%20evaluation%20perspectives%20of%20service%20quality%3A%20evaluation%20factors%20and%20two-way%20model%20of%20quality&author=SJ.%20Schvaneveldt&author=T.%20Enkawa&author=M.%20Miyakawa&journal=Total%20Qual.%20Manag.&volume=2&pages=149-161&publication_year=1991)
14. Kucukarslan, S.N., Nadkarni, A.: Evaluating medication-related services in a hospital setting using the disconfirmation of expectations model of satisfaction. *Res. Soc. Adm. Pharm.* **4**(1), 12–22 (2008)
[CrossRef](https://doi.org/10.1016/j.sapharm.2007.01.001) (https://doi.org/10.1016/j.sapharm.2007.01.001)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Evaluating%20medication-related%20services%20in%20a%20hospital%20setting%20using%20the%20disconfirmation%20of%20expectations%20model%20of%20satisfaction&author=SN.%20Kucukarslan&author=A.%20Nadkarni&journal=Res.%20Soc.%20Adm.%20Pharm.&volume=4&issue=1&pages=12-22&publication_year=2008) (http://scholar.google.com/scholar_lookup?title=Evaluating%20medication-related%20services%20in%20a%20hospital%20setting%20using%20the%20disconfirmation%20of%20expectations%20model%20of%20satisfaction&author=SN.%20Kucukarslan&author=A.%20Nadkarni&journal=Res.%20Soc.%20Adm.%20Pharm.&volume=4&issue=1&pages=12-22&publication_year=2008)
15. Laschinger, H.S., Hall, L.M., Pedersen, C., Almost, J.: A psychometric analysis of the patient satisfaction with nursing care quality questionnaire: an actionable approach to measuring patient satisfaction. *J. Nurs. Care Qual.* **20**(3), 220–230 (2005)
[CrossRef](https://doi.org/10.1097/00001786-200507000-00006) (https://doi.org/10.1097/00001786-200507000-00006)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20psychometric%20analysis%20of%20the%20patient%20satisfaction%20with%20nursing%20care%20quality%20questionnaire%3A%20an%20actionable%20approach%20to%20measuring%20patient%20satisfaction&author=HS.%20Laschinger&author=LM.%20Hall&author=C.%20Pedersen&author=J.%20Almost&journal=J.%20Nurs.%20Care%20Qual.&volume=20&issue=3&pages=220-230&publication_year=2005) (http://scholar.google.com/scholar_lookup?title=A%20psychometric%20analysis%20of%20the%20patient%20satisfaction%20with%20nursing%20care%20quality%20questionnaire%3A%20an%20actionable%20approach%20to%20measuring%20patient%20satisfaction&author=HS.%20Laschinger&author=LM.%20Hall&author=C.%20Pedersen&author=J.%20Almost&journal=J.%20Nurs.%20Care%20Qual.&volume=20&issue=3&pages=220-230&publication_year=2005)

16. Lupo, T.: Benchmarking of airports service quality by a new fuzzy MCDM approach. *Eur. Transp. Trasporti Europei* **57** (2015)
[Google Scholar](https://scholar.google.com/scholar?q=Lupo%2C%20T.%3A%20Benchmarking%20of%20airports%20service%20quality%20by%20a%20new%20fuzzy%20MCDM%20approach.%20Eur.%20Transp.%20Trasporti%20Europei%2057%20%282015%29) (<https://scholar.google.com/scholar?q=Lupo%2C%20T.%3A%20Benchmarking%20of%20airports%20service%20quality%20by%20a%20new%20fuzzy%20MCDM%20approach.%20Eur.%20Transp.%20Trasporti%20Europei%2057%20%282015%29>)
17. Fishbein, M., Ajzen, I.: *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Addison-Wesley, Reading (1975)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Belief%2C%20Attitude%2C%20Intention%20and%20Behavior%3A%20An%20Introduction%20to%20Theory%20and%20Research&author=M.%20Fishbein&author=I.%20Ajzen&publication_year=1975) (http://scholar.google.com/scholar_lookup?title=Belief%2C%20Attitude%2C%20Intention%20and%20Behavior%3A%20An%20Introduction%20to%20Theory%20and%20Research&author=M.%20Fishbein&author=I.%20Ajzen&publication_year=1975)
18. Saaty, T.L.: Decision making with the analytic hierarchy process. *Int. J. Serv. Sci.* **1**(1), 83–98 (2008)
[MathSciNet](http://www.ams.org/mathscinet-getitem?mr=881303) (<http://www.ams.org/mathscinet-getitem?mr=881303>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Decision%20making%20with%20the%20analytic%20hierarchy%20process&author=TL.%20Saaty&journal=Int.%20J.%20Serv.%20Sci.&volume=1&issue=1&pages=83-98&publication_year=2008) (http://scholar.google.com/scholar_lookup?title=Decision%20making%20with%20the%20analytic%20hierarchy%20process&author=TL.%20Saaty&journal=Int.%20J.%20Serv.%20Sci.&volume=1&issue=1&pages=83-98&publication_year=2008)
19. Opricovic, S., Tzeng, G.H.: Compromise solution by MCDM methods: a comparative analysis of VIKOR and TOPSIS. *Eur. J. Oper. Res.* **156**(2), 445–455 (2004)
[zbMATH](http://www.emis.de/MATH-item?1056.90090) (<http://www.emis.de/MATH-item?1056.90090>)
[CrossRef](https://doi.org/10.1016/S0377-2217(03)00020-1) ([https://doi.org/10.1016/S0377-2217\(03\)00020-1](https://doi.org/10.1016/S0377-2217(03)00020-1))
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Compromise%20solution%20by%20MCDM%20methods%3A%20a%20comparative%20analysis%20of%20VIKOR%20and%20TOPSIS&author=S.%20Opricovic&author=GH.%20Tzeng&journal=Eur.%20J.%20Oper.%20Res.&volume=156&issue=2&pages=445-455&publication_year=2004) (http://scholar.google.com/scholar_lookup?title=Compromise%20solution%20by%20MCDM%20methods%3A%20a%20comparative%20analysis%20of%20VIKOR%20and%20TOPSIS&author=S.%20Opricovic&author=GH.%20Tzeng&journal=Eur.%20J.%20Oper.%20Res.&volume=156&issue=2&pages=445-455&publication_year=2004)
20. Hwang, C.L., Yoon, K.: *Multiple Attribute Decision Making: Methods and Applications*. Springer, New York (1981). <https://doi.org/10.1007/978-3-642-48318-9> (<https://doi.org/10.1007/978-3-642-48318-9>)
[zbMATH](http://www.emis.de/MATH-item?0453.90002) (<http://www.emis.de/MATH-item?0453.90002>)
[CrossRef](https://doi.org/10.1007/978-3-642-48318-9) (<https://doi.org/10.1007/978-3-642-48318-9>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Multiple%20Attribute%20Decision%20Making%3A%20Methods%20and%20Applications&author=CL.%20Hwang&author=K.%20Yoon&publication_year=1981) (http://scholar.google.com/scholar_lookup?title=Multiple%20Attribute%20Decision%20Making%3A%20Methods%20and%20Applications&author=CL.%20Hwang&author=K.%20Yoon&publication_year=1981)
21. Li, Y., Hu, Y., Zhang, X., Deng, Y., Mahadevan, S.: An evidential DEMATEL method to identify critical success factors in emergency management. *Appl. Soft Comput. J.* **22**, 504–510 (2014)
[CrossRef](https://doi.org/10.1016/j.asoc.2014.03.042) (<https://doi.org/10.1016/j.asoc.2014.03.042>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=An%20evidential%20DEMATEL%20method%20to%20identify%20critical%20success%20factors%20in%20emergency%20management&author=Y.%20Li&author=Y.%20Hu&author=X.%20Zhang&author=Y.%20Deng&author=S.%20Mahadevan&journal=Appl.%20Soft%20Comput.%20J.&volume=22&pages=504-510&publication_year=2014) (http://scholar.google.com/scholar_lookup?title=An%20evidential%20DEMATEL%20method%20to%20identify%20critical%20success%20factors%20in%20emergency%20management&author=Y.%20Li&author=Y.%20Hu&author=X.%20Zhang&author=Y.%20Deng&author=S.%20Mahadevan&journal=Appl.%20Soft%20Comput.%20J.&volume=22&pages=504-510&publication_year=2014)

22. Chang, T.H.: Fuzzy VIKOR method: a case study of the hospital service evaluation in Taiwan. *Inf. Sci.* **271**, 196–212 (2014)
[CrossRef](https://doi.org/10.1016/j.ins.2014.02.118) (https://doi.org/10.1016/j.ins.2014.02.118)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Fuzzy%20VIKOR%20method%3A%20a%20case%20study%20of%20the%20hospital%20service%20evaluation%20in%20Taiwan&author=TH.%20Chang&journal=Inf.%20Sci.&volume=271&pages=196-212&publication_year=2014) (http://scholar.google.com/scholar_lookup?title=Fuzzy%20VIKOR%20method%3A%20a%20case%20study%20of%20the%20hospital%20service%20evaluation%20in%20Taiwan&author=TH.%20Chang&journal=Inf.%20Sci.&volume=271&pages=196-212&publication_year=2014)
23. Chou, C.C., Liu, L.J., Huang, S.F., Yih, J.M., Han, T.C.: An evaluation of airline service quality using the fuzzy weighted ServQual method. *Appl. Soft Comput.* **11**, 2117–2128 (2011)
[CrossRef](https://doi.org/10.1016/j.asoc.2010.07.010) (https://doi.org/10.1016/j.asoc.2010.07.010)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=An%20evaluation%20of%20airline%20service%20quality%20using%20the%20fuzzy%20weighted%20ServQual%20method&author=CC.%20Chou&author=LJ.%20Liu&author=SF.%20Huang&author=JM.%20Yih&author=TC.%20Han&journal=Appl.%20Soft%20Comput.&volume=11&pages=2117-2128&publication_year=2011) (http://scholar.google.com/scholar_lookup?title=An%20evaluation%20of%20airline%20service%20quality%20using%20the%20fuzzy%20weighted%20ServQual%20method&author=CC.%20Chou&author=LJ.%20Liu&author=SF.%20Huang&author=JM.%20Yih&author=TC.%20Han&journal=Appl.%20Soft%20Comput.&volume=11&pages=2117-2128&publication_year=2011)
24. De Battisti, F., Nicolini, G., Salini, S.: The Rasch model in customer satisfaction survey data. *Qual. Technol. Quant. Manag.* **7**(1), 15–34 (2010)
[CrossRef](https://doi.org/10.1080/16843703.2010.11673216) (https://doi.org/10.1080/16843703.2010.11673216)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=The%20Rasch%20model%20in%20customer%20satisfaction%20survey%20data&author=F.%20Battisti&author=G.%20Nicolini&author=S.%20Salini&journal=Qual.%20Technol.%20Quant.%20Manag.&volume=7&issue=1&pages=15-34&publication_year=2010) (http://scholar.google.com/scholar_lookup?title=The%20Rasch%20model%20in%20customer%20satisfaction%20survey%20data&author=F.%20Battisti&author=G.%20Nicolini&author=S.%20Salini&journal=Qual.%20Technol.%20Quant.%20Manag.&volume=7&issue=1&pages=15-34&publication_year=2010)
25. Hu, H.Y., Lee, Y.C., Yen, T.M.: Service quality gaps analysis based on fuzzy linguistic SERVQUAL with a case study in hospital out-patient services. *TQM J.* **22**(5), 499–515 (2010)
[CrossRef](https://doi.org/10.1108/17542731011072847) (https://doi.org/10.1108/17542731011072847)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Service%20quality%20gaps%20analysis%20based%20on%20fuzzy%20linguistic%20SERVQUAL%20with%20a%20case%20study%20in%20hospital%20out-patient%20services&author=HY.%20Hu&author=YC.%20Lee&author=TM.%20Yen&journal=TQM%20J.&volume=22&issue=5&pages=499-515&publication_year=2010) (http://scholar.google.com/scholar_lookup?title=Service%20quality%20gaps%20analysis%20based%20on%20fuzzy%20linguistic%20SERVQUAL%20with%20a%20case%20study%20in%20hospital%20out-patient%20services&author=HY.%20Hu&author=YC.%20Lee&author=TM.%20Yen&journal=TQM%20J.&volume=22&issue=5&pages=499-515&publication_year=2010)
26. Parasuraman, A., Zeithaml, V.A., Berry, L.L.: A conceptual model of service quality and its implications for future research. *J. Mark.* **49**, 41–50 (1985)
[CrossRef](https://doi.org/10.1177/002224298504900403) (https://doi.org/10.1177/002224298504900403)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20conceptual%20model%20of%20service%20quality%20and%20its%20implications%20for%20future%20research&author=A.%20Parasuraman&author=VA.%20Zeithaml&author=LL.%20Berry&journal=J.%20Mark.&volume=49&pages=41-50&publication_year=1985) (http://scholar.google.com/scholar_lookup?title=A%20conceptual%20model%20of%20service%20quality%20and%20its%20implications%20for%20future%20research&author=A.%20Parasuraman&author=VA.%20Zeithaml&author=LL.%20Berry&journal=J.%20Mark.&volume=49&pages=41-50&publication_year=1985)
27. Aktas, A., Cebi, S., Temiz, I.: A new evaluation model for service quality of healthcare systems based on AHP and information axiom. *J. Intell. Fuzzy Syst.* **28**, 1009–1021 (2015)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20new%20evaluation%20model%20for%20service%20quality%20of%2) (http://scholar.google.com/scholar_lookup?title=A%20new%20evaluation%20model%20for%20service%20quality%20of%2

ohealthcare%20systems%20based%20on%20AHP%20and%20information%20axiom&author=A.%20Aktas&author=S.%20Cebi&author=I.%20Temiz&journal=J.%20Intell.%20Fuzzy%20Syst.&volume=28&pages=1009-1021&publication_year=2015)

28. Baki, B., Peker, I.: An integrated evaluation model for service quality of hospitals: a case study from Turkey. *J. Mult. Valued Logic Soft Comput.* **24**(5–6), 453–474 (2015)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=An%20integrated%20evaluation%20model%20for%20service%20quality%20of%20hospitals%3A%20a%20case%20study%20from%20Turkey&author=B.%20Baki&author=I.%20Peker&journal=J.%20Mult.%20Valued%20Logic%20Soft%20Comput.&volume=24&issue=5&pages=453-474&publication_year=2015) (http://scholar.google.com/scholar_lookup?title=An%20integrated%20evaluation%20model%20for%20service%20quality%20of%20hospitals%3A%20a%20case%20study%20from%20Turkey&author=B.%20Baki&author=I.%20Peker&journal=J.%20Mult.%20Valued%20Logic%20Soft%20Comput.&volume=24&issue=5&pages=453-474&publication_year=2015)
29. Lee, G., Lin, H.: Customer perceptions of e-service quality in online shopping. *Int. J. Retail Distrib. Manag.* **33**(2), 161–176 (2005)
[CrossRef](https://doi.org/10.1108/09590550510581485) (<https://doi.org/10.1108/09590550510581485>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Customer%20perceptions%20of%20e-service%20quality%20in%20online%20shopping&author=G.%20Lee&author=H.%20Lin&journal=Int.%20J.%20Retail%20Distrib.%20Manag.&volume=33&issue=2&pages=161-176&publication_year=2005) (http://scholar.google.com/scholar_lookup?title=Customer%20perceptions%20of%20e-service%20quality%20in%20online%20shopping&author=G.%20Lee&author=H.%20Lin&journal=Int.%20J.%20Retail%20Distrib.%20Manag.&volume=33&issue=2&pages=161-176&publication_year=2005)
30. Mardani, A., Jusoh, A., Zavadskas, E.K.: Fuzzy multiple criteria decision-making techniques and applications: two decades review from 1994 to 2014. *Expert Syst. Appl.* **42**(8), 4126–4148 (2015)
[CrossRef](https://doi.org/10.1016/j.eswa.2015.01.003) (<https://doi.org/10.1016/j.eswa.2015.01.003>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Fuzzy%20multiple%20criteria%20decision-making%20techniques%20and%20applications%3A%20two%20decades%20review%20from%201994%20to%202014&author=A.%20Mardani&author=A.%20Jusoh&author=EK.%20Zavadskas&journal=Expert%20Syst.%20Appl.&volume=42&issue=8&pages=4126-4148&publication_year=2015) (http://scholar.google.com/scholar_lookup?title=Fuzzy%20multiple%20criteria%20decision-making%20techniques%20and%20applications%3A%20two%20decades%20review%20from%201994%20to%202014&author=A.%20Mardani&author=A.%20Jusoh&author=EK.%20Zavadskas&journal=Expert%20Syst.%20Appl.&volume=42&issue=8&pages=4126-4148&publication_year=2015)
31. Calabrese, A.: Service productivity and service quality: a necessary trade-off? *Prod. Int. J. Econ.* **135**(2), 800–812 (2012)
[CrossRef](https://doi.org/10.1016/j.ijpe.2011.10.014) (<https://doi.org/10.1016/j.ijpe.2011.10.014>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Service%20productivity%20and%20service%20quality%3A%20a%20necessary%20trade-off%3F&author=A.%20Calabrese&journal=Prod.%20Int.%20J.%20Econ.&volume=135&issue=2&pages=800-812&publication_year=2012) (http://scholar.google.com/scholar_lookup?title=Service%20productivity%20and%20service%20quality%3A%20a%20necessary%20trade-off%3F&author=A.%20Calabrese&journal=Prod.%20Int.%20J.%20Econ.&volume=135&issue=2&pages=800-812&publication_year=2012)
32. Babakus, E., Boller, G.W.: An empirical assessment of the SERVQUAL scale. *J. Bus. Res.* **24**(3), 253–268 (1992)
[CrossRef](https://doi.org/10.1016/0148-2963(92)90022-4) ([https://doi.org/10.1016/0148-2963\(92\)90022-4](https://doi.org/10.1016/0148-2963(92)90022-4))
[Google Scholar](http://scholar.google.com/scholar_lookup?title=An%20empirical%20assessment%20of%20the%20SERVQUAL%20scale&author=E.%20Babakus&author=GW.%20Boller&journal=J.%20Bus.%20Res.&volume=24&issue=3&pages=253-268&publication_year=1992) (http://scholar.google.com/scholar_lookup?title=An%20empirical%20assessment%20of%20the%20SERVQUAL%20scale&author=E.%20Babakus&author=GW.%20Boller&journal=J.%20Bus.%20Res.&volume=24&issue=3&pages=253-268&publication_year=1992)
33. Wasserman, G.S.: On how to prioritize design requirements during the QFD planning process. *IIE Trans.* **25**(3), 59–65 (1993)

[CrossRef](https://doi.org/10.1080/07408179308964291) (https://doi.org/10.1080/07408179308964291)

[Google Scholar](http://scholar.google.com/scholar_lookup?title=On%20how%20to%20prioritize%20design%20requirements%20during%20the%20QFD%20planning%20process&author=GS.%20Wasserman&journal=IIE%20Trans.&volume=25&issue=3&pages=59-65&publication_year=1993) (http://scholar.google.com/scholar_lookup?

title=On%20how%20to%20prioritize%20design%20requirements%20during%20the%20QFD%20planning%20process&author=GS.%20Wasserman&journal=IIE%20Trans.&volume=25&issue=3&pages=59-65&publication_year=1993)

34. Sgroi, F., Tudisca, S., Di Trapani, A.M., Testa, R.: Economic evaluation of aquaculture investments under conditions of risk and uncertainty in the Mediterranean Sea. *Am. J. Appl. Sci.* **11**, 1727–1734 (2014)
[CrossRef](https://doi.org/10.3844/ajassp.2014.1727.1734) (https://doi.org/10.3844/ajassp.2014.1727.1734)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Economic%20evaluation%20of%20aquaculture%20investments%20under%20conditions%20of%20risk%20and%20uncertainty%20in%20the%20Mediterranean%20Sea&author=F.%20Sgroi&author=S.%20Tudisca&author=AM.%20Trapani&author=R.%20Testa&journal=Am.%20J.%20Appl.%20Sci.&volume=11&pages=1727-1734&publication_year=2014) (http://scholar.google.com/scholar_lookup?title=Economic%20evaluation%20of%20aquaculture%20investments%20under%20conditions%20of%20risk%20and%20uncertainty%20in%20the%20Mediterranean%20Sea&author=F.%20Sgroi&author=S.%20Tudisca&author=AM.%20Trapani&author=R.%20Testa&journal=Am.%20J.%20Appl.%20Sci.&volume=11&pages=1727-1734&publication_year=2014)
35. Sgroi, F., Tudisca, S., Di Trapani, A.M., Testa, R., Squatrito, R.: Efficacy and efficiency of Italian energy policy: the case of PV systems in greenhouse farms. *Energies* **7**(6), 3985–4001 (2014)
[CrossRef](https://doi.org/10.3390/en7063985) (https://doi.org/10.3390/en7063985)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Efficacy%20and%20efficiency%20of%20Italian%20energy%20policy%3A%20the%20case%20of%20PV%20systems%20in%20greenhouse%20farms&author=F.%20Sgroi&author=S.%20Tudisca&author=AM.%20Trapani&author=R.%20Testa&author=R.%20Squatrito&journal=Energies&volume=7&issue=6&pages=3985-4001&publication_year=2014) (http://scholar.google.com/scholar_lookup?title=Efficacy%20and%20efficiency%20of%20Italian%20energy%20policy%3A%20the%20case%20of%20PV%20systems%20in%20greenhouse%20farms&author=F.%20Sgroi&author=S.%20Tudisca&author=AM.%20Trapani&author=R.%20Testa&author=R.%20Squatrito&journal=Energies&volume=7&issue=6&pages=3985-4001&publication_year=2014)
36. Zadeh, L.: Fuzzy sets. *Inf. Control* **8**, 338–353 (1965)
[zbMATH](http://www.emis.de/MATH-item?0139.24606) (http://www.emis.de/MATH-item?0139.24606)
[CrossRef](https://doi.org/10.1016/S0019-9958(65)90241-X) (https://doi.org/10.1016/S0019-9958(65)90241-X)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Fuzzy%20sets&author=L.%20Zadeh&journal=Inf.%20Control&volume=8&pages=338-353&publication_year=1965) (http://scholar.google.com/scholar_lookup?title=Fuzzy%20sets&author=L.%20Zadeh&journal=Inf.%20Control&volume=8&pages=338-353&publication_year=1965)
37. Certa, A., Enea, M., Galante, G.M., La Fata, C.M.: A multistep methodology for the evaluation of human resources using the evidence theory. *Int. J. Intell. Syst.* **28**(11), 1072–1088 (2013)
[CrossRef](https://doi.org/10.1002/int.21617) (https://doi.org/10.1002/int.21617)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20multistep%20methodology%20for%20the%20evaluation%20of%20human%20resources%20using%20the%20evidence%20theory&author=A.%20Certa&author=M.%20Enea&author=GM.%20Galante&author=CM.%20Fata&journal=Int.%20J.%20Intell.%20Syst.&volume=28&issue=11&pages=1072-1088&publication_year=2013) (http://scholar.google.com/scholar_lookup?title=A%20multistep%20methodology%20for%20the%20evaluation%20of%20human%20resources%20using%20the%20evidence%20theory&author=A.%20Certa&author=M.%20Enea&author=GM.%20Galante&author=CM.%20Fata&journal=Int.%20J.%20Intell.%20Syst.&volume=28&issue=11&pages=1072-1088&publication_year=2013)
38. Montes, R., Sánchez, A.M., Villar, P., Herrera, F.: A web tool to support decision making in the housing market using hesitant fuzzy linguistic termsets. *Appl. Soft Comput.* **35**, 949–957 (2015)
[CrossRef](https://doi.org/10.1016/j.asoc.2015.01.030) (https://doi.org/10.1016/j.asoc.2015.01.030)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20web%20tool%20to%20support%20decision%20making%20in%20the%20housing%20market%20using%20hesitant%20fuzzy%20linguistic%20termset) (http://scholar.google.com/scholar_lookup?title=A%20web%20tool%20to%20support%20decision%20making%20in%20the%20housing%20market%20using%20hesitant%20fuzzy%20linguistic%20termset

s&author=R.%20Montes&author=AM.%20S%C3%A1nchez&author=P.%20Villar
&author=F.%20Herrera&journal=Appl.%20Soft%20Comput.&volume=35&pages
=949-957&publication_year=2015)

39. Heradio, R., Cabrerizo, F.J., Fernandez-Amoros, D., Herrera, M., Herrera-Viedma, E.: A fuzzy linguistic model to evaluate the quality of library 2.0 functionalities. *Int. J. Inf. Manag.* **33**(4), 642–654 (2013)
CrossRef (<https://doi.org/10.1016/j.ijinfomgt.2013.04.001>)
Google Scholar (http://scholar.google.com/scholar_lookup?title=A%20ofuzzy%20linguistic%20model%20to%20evaluate%20the%20quality%20of%20library%202.0%20functionalities&author=R.%20Heradio&author=FJ.%20Cabrerizo&author=D.%20Fernandez-Amoros&author=M.%20Herrera&author=E.%20Herrera-Viedma&journal=Int.%20J.%20Inf.%20Manag.&volume=33&issue=4&pages=642-654&publication_year=2013)
40. Cabrerizo, F.J., Martínez, M.A., López-Gijón, J., Esteban, B., Herrera-Viedma, E.: A new quality evaluation model generating recommendations to improve the digital services provided by the academic digital libraries. In: 2011 International Fuzzy Systems Association World Congress and the 2011 Asian Fuzzy Systems Society (IFSA 2011), Surabaya and Bali Island (Indonesia), pp. RW 202 1–RW 202 6 (2011)
Google Scholar (<https://scholar.google.com/scholar?q=Cabrerizo%2C%20F.J.%2C%20Mart%C3%ADnez%2C%20M.A.%2C%20L%C3%B3pez-Gij%C3%B3n%2C%20J.%2C%20Esteban%2C%20B.%2C%20Herrera-Viedma%2C%20E.%3A%20Anew%20quality%20evaluation%20model%20generating%20recommendations%20to%20improve%20the%20digital%20services%20provided%20by%20the%20academic%20digital%20libraries.%20In%3A%202011%20International%20Fuzzy%20Systems%20Association%20World%20Congress%20and%20the%202011%20Asian%20Fuzzy%20Systems%20Society%20%28IFSA%202011%29%2C%20Surabaya%20and%20Bali%20Island%20%28Indonesia%29%2C%20pp.%20RW%20202%201%E2%80%93RW%20202%206%20%282011%29>)
41. López-Herrera, A.G., Herrera-Viedma, E., Herrera, F.: Applying multi-objective evolutionary algorithms to the automatic learning of extended boolean queries in fuzzy ordinal linguistic information retrieval systems. *Fuzzy Sets Syst.* **160**, 2192–2205 (2009)
MathSciNet (<http://www.ams.org/mathscinet-getitem?mr=2546902>)
CrossRef (<https://doi.org/10.1016/j.fss.2009.02.013>)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Applying%20multi-objective%20evolutionary%20algorithms%20to%20the%20automatic%20learning%20of%20extended%20boolean%20queries%20in%20fuzzy%20ordinal%20linguistic%20information%20retrieval%20systems&author=AG.%20L%C3%B3pez-Herrera&author=E.%20Herrera-Viedma&author=F.%20Herrera&journal=Fuzzy%20Sets%20Syst.&volume=160&pages=2192-2205&publication_year=2009)
42. Bogetoft, P., Pruzan, P.: Planning with multiple criteria: investigation, communication and choice. *J. Multi-Criteria Decis. Anal.* **8**(2), 112 (1997)
zbMATH (<http://www.emis.de/MATH-item?0956.90036>)

- Google Scholar (http://scholar.google.com/scholar_lookup?title=Planning%20with%20multiple%20criteria%3A%20investigation%2C%20communication%20and%20choice&author=P.%20Bogetoft&author=P.%20Pruzan&journal=J.%20Multi-Criteria%20Decis.%20Anal.&volume=8&issue=2&pages=112&publication_year=1997)
43. Dodgson, J., Spackman, M., Pearman, A., Phillips, L.: Multi-criteria analysis: a manual. Department for Communities and Local Government, London (2009). <http://eprints.lse.ac.uk/12761/> (<http://eprints.lse.ac.uk/12761/>)
44. Abbas, M., Ahmad, J., Edmundas, K.Z., Zainab, K., Khalil, M.D.N.: Application of multiple-criteria decision-making techniques and approaches to evaluating of service quality: a systematic review of the literature. *J. Bus. Econ. Manag.* **16**(5), 1034–1068 (2015)
CrossRef (<https://doi.org/10.3846/16111699.2015.1095233>)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Application%20of%20multiple-criteria%20decision-making%20techniques%20and%20approaches%20to%20evaluating%20of%20service%20quality%3A%20a%20systematic%20review%20of%20the%20literature&author=M.%20Abbas&author=J.%20Ahmad&author=KZ.%20Edmundas&author=K.%20Zainab&author=MDN.%20Khalil&journal=J.%20Bus.%20Econ.%20Manag.&volume=16&issue=5&pages=1034-1068&publication_year=2015)
45. Hwang, C.L., Yoon, K.: Multiple Attribute Decision-Making Methods and Applications. Springer, Heidelberg (1981). <https://doi.org/10.1007/978-3-642-48318-9> (<https://doi.org/10.1007/978-3-642-48318-9>)
zbMATH (<http://www.emis.de/MATH-item?0453.90002>)
CrossRef (<https://doi.org/10.1007/978-3-642-48318-9>)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Multiple%20Attribute%20Decision-Making%20Methods%20and%20Applications&author=CL.%20Hwang&author=K.%20Yoon&publication_year=1981)
46. Simpson, L.: Do decision makers know what they prefer?: MAVT and ELECTRE II. *J. Oper. Res. Soc.* **47**(7), 919–929 (1996)
zbMATH (<http://www.emis.de/MATH-item?0864.90071>)
CrossRef (<https://doi.org/10.1057/jors.1996.117>)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Do%20decision%20makers%20know%20what%20they%20prefer%3F%3A%20MAVT%20and%20ELECTRE%20II&author=L.%20Simpson&journal=J.%20Oper.%20Res.%20Soc.&volume=47&issue=7&pages=919-929&publication_year=1996)
47. Musumba, G.W., Wario, R.D.: Towards group fuzzy analytical hierarchy process. In: Mekuria, F., Nigussie, E.E., Dargie, W., Edward, M., Tegegne, T. (eds.) *ICT4DA 2017*. LNICST, vol. 244, pp. 283–307. Springer, Cham (2018). https://doi.org/10.1007/978-3-319-95153-9_27 (https://doi.org/10.1007/978-3-319-95153-9_27)
CrossRef (https://doi.org/10.1007/978-3-319-95153-9_27)
Google Scholar (http://scholar.google.com/scholar_lookup?title=Towards%20group%20fuzzy%20analytical%20hierarchy%20process&autho

r=GW.%20Musumba&author=RD.%20Wario&pages=283-307&publication_year=2018)

48. Saaty, T.L.: The Analytic Hierarchy Process. McGraw-Hill, New York (1980)
[zbMATH](http://www.emis.de/MATH-item?0587.90002) (http://www.emis.de/MATH-item?0587.90002)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=The%20Analytic%20Hierarchy%20Process&author=TL.%20Saaty&publication_year=1980) (http://scholar.google.com/scholar_lookup?title=The%20Analytic%20Hierarchy%20Process&author=TL.%20Saaty&publication_year=1980)
49. Saaty, T.L., Vargas, L.G.: Models, methods, concepts & applications of the analytic hierarchy process, vol. 175. Springer, New York (2001).
<https://doi.org/10.1007/978-1-4614-3597-6> (https://doi.org/10.1007/978-1-4614-3597-6)
[zbMATH](http://www.emis.de/MATH-item?1241.90002) (http://www.emis.de/MATH-item?1241.90002)
[CrossRef](https://doi.org/10.1007/978-1-4614-3597-6) (https://doi.org/10.1007/978-1-4614-3597-6)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Models%2C%20methods%2C%20concepts%20%26%20applications%20of%20the%20analytic%20hierarchy%20process&author=TL.%20Saaty&author=LG.%20Vargas&publication_year=2001) (http://scholar.google.com/scholar_lookup?title=Models%2C%20methods%2C%20concepts%20%26%20applications%20of%20the%20analytic%20hierarchy%20process&author=TL.%20Saaty&author=LG.%20Vargas&publication_year=2001)
50. Vaidya, O., Kumar, S.: Analytic hierarchy process: an overview of applications. *Eur. J. Oper. Res.* **169**(1), 1–29 (2006)
[MathSciNet](http://www.ams.org/mathscinet-getitem?mr=2169628) (http://www.ams.org/mathscinet-getitem?mr=2169628)
[zbMATH](http://www.emis.de/MATH-item?1077.90542) (http://www.emis.de/MATH-item?1077.90542)
[CrossRef](https://doi.org/10.1016/j.ejor.2004.04.028) (https://doi.org/10.1016/j.ejor.2004.04.028)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Analytic%20hierarchy%20process%3A%20an%20overview%20of%20applications&author=O.%20Vaidya&author=S.%20Kumar&journal=Eur.%20J.%20Oper.%20Res.&volume=169&issue=1&pages=1-29&publication_year=2006) (http://scholar.google.com/scholar_lookup?title=Analytic%20hierarchy%20process%3A%20an%20overview%20of%20applications&author=O.%20Vaidya&author=S.%20Kumar&journal=Eur.%20J.%20Oper.%20Res.&volume=169&issue=1&pages=1-29&publication_year=2006)
51. Mikhailov, L.: Deriving priorities from fuzzy pairwise comparison judgements. *Fuzzy Sets Syst.* **134**(3), 365–385 (2003)
[MathSciNet](http://www.ams.org/mathscinet-getitem?mr=1962303) (http://www.ams.org/mathscinet-getitem?mr=1962303)
[zbMATH](http://www.emis.de/MATH-item?1031.90073) (http://www.emis.de/MATH-item?1031.90073)
[CrossRef](https://doi.org/10.1016/S0165-0114(02)00383-4) (https://doi.org/10.1016/S0165-0114(02)00383-4)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Deriving%20priorities%20from%20fuzzy%20pairwise%20comparison%20judgements&author=L.%20Mikhailov&journal=Fuzzy%20Sets%20Syst.&volume=134&issue=3&pages=365-385&publication_year=2003) (http://scholar.google.com/scholar_lookup?title=Deriving%20priorities%20from%20fuzzy%20pairwise%20comparison%20judgements&author=L.%20Mikhailov&journal=Fuzzy%20Sets%20Syst.&volume=134&issue=3&pages=365-385&publication_year=2003)
52. van Laarhoven, P., van Pedrycz, W.: A fuzzy extension of Saaty's priority theory. *Fuzzy Sets Syst.* **11**(1), 199–227 (1983)
[MathSciNet](http://www.ams.org/mathscinet-getitem?mr=727206) (http://www.ams.org/mathscinet-getitem?mr=727206)
[zbMATH](http://www.emis.de/MATH-item?0528.90054) (http://www.emis.de/MATH-item?0528.90054)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20fuzzy%20extension%20of%20Saaty%E2%80%99s%20priority%20theory&author=P.%20Laarhoven&author=W.%20Pedrycz&journal=Fuzzy%20Sets%20Syst.&volume=11&issue=1&pages=199-227&publication_year=1983) (http://scholar.google.com/scholar_lookup?title=A%20fuzzy%20extension%20of%20Saaty%E2%80%99s%20priority%20theory&author=P.%20Laarhoven&author=W.%20Pedrycz&journal=Fuzzy%20Sets%20Syst.&volume=11&issue=1&pages=199-227&publication_year=1983)
53. Ahmad, A., Basir, O., Hassanein, K.: Adaptive user interfaces for intelligent e-learning: issues and trends. In: Proceedings of the Fourth International Conference on Electronic Business (ICEB 2004), Beijing, pp. 925–934 (2004)
[Google Scholar](https://scholar.google.com/scholar?q=Ahmad%2C%20A.%2C%20Basir%2C%20O.%2C%20Hassanein%2C%20K.%3A) (https://scholar.google.com/scholar?q=Ahmad%2C%20A.%2C%20Basir%2C%20O.%2C%20Hassanein%2C%20K.%3A

%20Adaptive%20user%20interfaces%20for%20intelligent%20e-learning%3A%20issues%20and%20trends.%20In%3A%20Proceedings%20of%20the%20Fourth%20International%20Conference%20on%20Electronic%20Business%20%28ICEB%202004%29%2C%20Beijing%2C%20pp.%20925%E2%80%93934%20%282004%29)

54. Tseng, M.L.: A causal and effect decision making model of service quality expectation using grey-fuzzy DEMATEL approach. *Expert Syst. Appl.* **36**(4), 7738–7748 (2009)
[CrossRef](https://doi.org/10.1016/j.eswa.2008.09.011) (<https://doi.org/10.1016/j.eswa.2008.09.011>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20causal%20and%20effect%20decision%20making%20model%20of%20service%20quality%20expectation%20using%20grey-fuzzy%20DEMATEL%20approach&author=ML.%20Tseng&journal=Expert%20Syst.%20Appl.&volume=36&issue=4&pages=7738-7748&publication_year=2009) (http://scholar.google.com/scholar_lookup?title=A%20causal%20and%20effect%20decision%20making%20model%20of%20service%20quality%20expectation%20using%20grey-fuzzy%20DEMATEL%20approach&author=ML.%20Tseng&journal=Expert%20Syst.%20Appl.&volume=36&issue=4&pages=7738-7748&publication_year=2009)
55. Li, L.X.: Relationships between determinants of hospital quality management and service quality performance – a path analytic model. *Omega* **25**(5), 535–545 (1997)
[CrossRef](https://doi.org/10.1016/S0305-0483(97)00017-0) ([https://doi.org/10.1016/S0305-0483\(97\)00017-0](https://doi.org/10.1016/S0305-0483(97)00017-0))
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Relationships%20between%20determinants%20of%20hospital%20quality%20management%20and%20service%20quality%20performance%20%E2%80%93%20a%20path%20analytic%20model&author=LX.%20Li&journal=Omega&volume=25&issue=5&pages=535-545&publication_year=1997) (http://scholar.google.com/scholar_lookup?title=Relationships%20between%20determinants%20of%20hospital%20quality%20management%20and%20service%20quality%20performance%20%E2%80%93%20a%20path%20analytic%20model&author=LX.%20Li&journal=Omega&volume=25&issue=5&pages=535-545&publication_year=1997)
56. Min, H., Mitra, A., Oswald, S.: Competitive benchmarking of health care quality using the analytic hierarchy process: an example from Korean cancer clinics. *Soc.-Econ. Plan. Sci.* **31**(2), 147–159 (1997)
[CrossRef](https://doi.org/10.1016/S0038-0121(96)00021-3) ([https://doi.org/10.1016/S0038-0121\(96\)00021-3](https://doi.org/10.1016/S0038-0121(96)00021-3))
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Competitive%20benchmarking%20of%20health%20care%20quality%20using%20the%20analytic%20hierarchy%20process%3A%20an%20example%20from%20Korean%20cancer%20clinics&author=H.%20Min&author=A.%20Mitra&author=S.%20Oswald&journal=Soc.-Econ.%20Plan.%20Sci.&volume=31&issue=2&pages=147-159&publication_year=1997) (http://scholar.google.com/scholar_lookup?title=Competitive%20benchmarking%20of%20health%20care%20quality%20using%20the%20analytic%20hierarchy%20process%3A%20an%20example%20from%20Korean%20cancer%20clinics&author=H.%20Min&author=A.%20Mitra&author=S.%20Oswald&journal=Soc.-Econ.%20Plan.%20Sci.&volume=31&issue=2&pages=147-159&publication_year=1997)
57. Chang, S.J., Hsiao, H.C., Huang, L.H., Chang, H.: Taiwan quality indicator project and hospital productivity growth. *Omega* **39**(1), 14–22 (2011)
[CrossRef](https://doi.org/10.1016/j.omega.2010.01.006) (<https://doi.org/10.1016/j.omega.2010.01.006>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Taiwan%20quality%20indicator%20project%20and%20hospital%20productivity%20growth&author=SJ.%20Chang&author=HC.%20Hsiao&author=LH.%20Huang&author=H.%20Chang&journal=Omega&volume=39&issue=1&pages=14-22&publication_year=2011) (http://scholar.google.com/scholar_lookup?title=Taiwan%20quality%20indicator%20project%20and%20hospital%20productivity%20growth&author=SJ.%20Chang&author=HC.%20Hsiao&author=LH.%20Huang&author=H.%20Chang&journal=Omega&volume=39&issue=1&pages=14-22&publication_year=2011)
58. Teng, C.I., Ing, C.K., Chang, H.Y., Chung, K.P.: Development of service quality scale for surgical hospitalization. *J. Formos. Med. Assoc.* **106**(6), 475–484 (2007)
[CrossRef](https://doi.org/10.1016/S0929-6646(09)60297-7) ([https://doi.org/10.1016/S0929-6646\(09\)60297-7](https://doi.org/10.1016/S0929-6646(09)60297-7))
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Development%20of%20service%20quality%20scale%20for%20surgical%20hospitalization&author=CI.%20Teng&author=CK.%20Ing&author=HY.%20Chan) (http://scholar.google.com/scholar_lookup?title=Development%20of%20service%20quality%20scale%20for%20surgical%20hospitalization&author=CI.%20Teng&author=CK.%20Ing&author=HY.%20Chan)

g&author=KP.%20Chung&journal=J.%20Formos.%20Med.%20Assoc.&volume=106&issue=6&pages=475-484&publication_year=2007)

59. Shieh, J.I., Wu, H.-H., Huang, K.K.: A DEMATEL method in identifying key success factors of hospital service quality. *Knowl.-Based Syst.* **23**(3), 277–282 (2010)
[CrossRef](https://doi.org/10.1016/j.knosys.2010.01.013) (https://doi.org/10.1016/j.knosys.2010.01.013)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20DEMATEL%20method%20in%20identifying%20key%20success%20of%20actors%20of%20hospital%20service%20quality&author=JI.%20Shieh&author=H.-H.%20Wu&author=KK.%20Huang&journal=Knowl.-Based%20Syst.&volume=23&issue=3&pages=277-282&publication_year=2010) (http://scholar.google.com/scholar_lookup?title=A%20DEMATEL%20method%20in%20identifying%20key%20success%20of%20actors%20of%20hospital%20service%20quality&author=JI.%20Shieh&author=H.-H.%20Wu&author=KK.%20Huang&journal=Knowl.-Based%20Syst.&volume=23&issue=3&pages=277-282&publication_year=2010)
60. Kubler, S., Robert, J., Derigent, W., Voisin, A., Le Traon, Y.: A state-of-the-art survey & testbed of Fuzzy AHP (FAHP) applications. *Expert Syst. Appl.* **65**, 398–422 (2016)
[CrossRef](https://doi.org/10.1016/j.eswa.2016.08.064) (https://doi.org/10.1016/j.eswa.2016.08.064)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20state-of%20the-art%20survey%20%26%20testbed%20of%20Fuzzy%20AHP%20%28FAHP%29%20applications&author=S.%20Kubler&author=J.%20Robert&author=W.%20Derigent&author=A.%20Voisin&author=Y.%20Traon&journal=Expert%20Syst.%20Appl.&volume=65&pages=398-422&publication_year=2016) (http://scholar.google.com/scholar_lookup?title=A%20state-of%20the-art%20survey%20%26%20testbed%20of%20Fuzzy%20AHP%20%28FAHP%29%20applications&author=S.%20Kubler&author=J.%20Robert&author=W.%20Derigent&author=A.%20Voisin&author=Y.%20Traon&journal=Expert%20Syst.%20Appl.&volume=65&pages=398-422&publication_year=2016)
61. Büyüközkan, G., Cifci, G., Güteryüz, S.: Strategic analysis of healthcare service quality using fuzzy AHP methodology. *Expert Syst. Appl.* **38**(8), 9407–9424 (2011)
[CrossRef](https://doi.org/10.1016/j.eswa.2011.01.103) (https://doi.org/10.1016/j.eswa.2011.01.103)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Strategic%20analysis%20of%20healthcare%20service%20quality%20using%20fuzzy%20AHP%20methodology&author=G.%20B%C3%BCy%C3%BCh%C3%B6zkan&author=G.%20Cifci&author=S.%20G%C3%BClery%C3%BCz&journal=Expert%20Syst.%20Appl.&volume=38&issue=8&pages=9407-9424&publication_year=2011) (http://scholar.google.com/scholar_lookup?title=Strategic%20analysis%20of%20healthcare%20service%20quality%20using%20fuzzy%20AHP%20methodology&author=G.%20B%C3%BCy%C3%BCh%C3%B6zkan&author=G.%20Cifci&author=S.%20G%C3%BClery%C3%BCz&journal=Expert%20Syst.%20Appl.&volume=38&issue=8&pages=9407-9424&publication_year=2011)
62. Ju, Y., Wang, A., Liu, X.: Evaluating emergency response capacity by Fuzzy AHP: and 2-tuple fuzzy linguistic approach. *Expert Syst. Appl.* **39**(8), 6972–6981 (2012)
[CrossRef](https://doi.org/10.1016/j.eswa.2012.01.061) (https://doi.org/10.1016/j.eswa.2012.01.061)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Evaluating%20emergency%20response%20capacity%20by%20Fuzzy%20AHP%3A%20and%202-tuple%20fuzzy%20linguistic%20approach&author=Y.%20Ju&author=A.%20Wang&author=X.%20Liu&journal=Expert%20Syst.%20Appl.&volume=39&issue=8&pages=6972-6981&publication_year=2012) (http://scholar.google.com/scholar_lookup?title=Evaluating%20emergency%20response%20capacity%20by%20Fuzzy%20AHP%3A%20and%202-tuple%20fuzzy%20linguistic%20approach&author=Y.%20Ju&author=A.%20Wang&author=X.%20Liu&journal=Expert%20Syst.%20Appl.&volume=39&issue=8&pages=6972-6981&publication_year=2012)
63. Shahin, A., Janatyan, N.: Estimation of customer dissatisfaction based on service quality gaps by correlation and regression analysis in a travel agency. *Int. J. Bus. Manag.* **6**(3), 99–108 (2011)
[CrossRef](https://doi.org/10.5539/ijbm.v6n3p99) (https://doi.org/10.5539/ijbm.v6n3p99)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Estimation%20of%20customer%20dissatisfaction%20based%20on%20service%20quality%20gaps%20by%20correlation%20and%20regression%20analysis%20in%20a%20travel%20agency&author=A.%20Shahin&author=N.%20Janatya) (http://scholar.google.com/scholar_lookup?title=Estimation%20of%20customer%20dissatisfaction%20based%20on%20service%20quality%20gaps%20by%20correlation%20and%20regression%20analysis%20in%20a%20travel%20agency&author=A.%20Shahin&author=N.%20Janatya)

n&journal=Int.%20J.%20Bus.%20Manag.&volume=6&issue=3&pages=99-108&publication_year=2011)

64. Zaim, H., Bayyurt, N., Zaim, S.: Service quality and determinants of customer satisfaction in hospitals: Turkish experience. *Int. Bus. Econ. Res. J.* **9**(5), 51 (2010)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Service%20quality%20and%20determinants%20of%20customer%20satisfaction%20in%20hospitals%3A%20Turkish%20experience&author=H.%20Zaim&author=N.%20Bayyurt&author=S.%20Zaim&journal=Int.%20Bus.%20Econ.%20Res.%20J.&volume=9&issue=5&pages=51&publication_year=2010) (http://scholar.google.com/scholar_lookup?title=Service%20quality%20and%20determinants%20of%20customer%20satisfaction%20in%20hospitals%3A%20Turkish%20experience&author=H.%20Zaim&author=N.%20Bayyurt&author=S.%20Zaim&journal=Int.%20Bus.%20Econ.%20Res.%20J.&volume=9&issue=5&pages=51&publication_year=2010)
65. Parasuraman, A., Zeithaml, V.A., Berry, L.L.: An empirical test of the extended gaps model of service quality. In: Marketing Science Institute Working Paper, pp. 90–122 (1990)
[Google Scholar](https://scholar.google.com/scholar?q=Parasuraman%2C%20A.%2C%20Zeithaml%2C%20V.A.%2C%20Berry%2C%20L.L.%3A%20An%20empirical%20test%20of%20the%20extended%20gaps%20model%20of%20service%20quality.%20In%3A%20Marketing%20Science%20Institute%20Working%20Paper%2C%20pp.%2090%2D%20122%20%281990%29) (<https://scholar.google.com/scholar?q=Parasuraman%2C%20A.%2C%20Zeithaml%2C%20V.A.%2C%20Berry%2C%20L.L.%3A%20An%20empirical%20test%20of%20the%20extended%20gaps%20model%20of%20service%20quality.%20In%3A%20Marketing%20Science%20Institute%20Working%20Paper%2C%20pp.%2090%2D%20122%20%281990%29>)
66. Bitner, M.J., Hubbert, A.R.: Encounter satisfaction versus overall satisfaction versus service quality: the consumer's voice. In: Rust, R.T., Oliver, R.L. (eds.) *Service Quality: New Directions in Theory and Practice*, pp. 72–94. Sage Publications, Thousand Oaks (1994)
[CrossRef](https://doi.org/10.4135/9781452229102.n3) (<https://doi.org/10.4135/9781452229102.n3>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Encounter%20satisfaction%20versus%20overall%20satisfaction%20versus%20service%20quality%3A%20the%20consumer%20voice&author=MJ.%20Bitner&author=AR.%20Hubbert&pages=72-94&publication_year=1994) (http://scholar.google.com/scholar_lookup?title=Encounter%20satisfaction%20versus%20overall%20satisfaction%20versus%20service%20quality%3A%20the%20consumer%20voice&author=MJ.%20Bitner&author=AR.%20Hubbert&pages=72-94&publication_year=1994)
67. Prakash, A., Mohanty, R.P., Kallurkar, S.P.: Service quality modelling for life insurance business using neural networks. *Int. J. Prod. Qual. Manag.* **7**(3), 263–286 (2011)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Service%20quality%20modelling%20for%20life%20insurance%20business%20using%20neural%20networks&author=A.%20Prakash&author=RP.%20Mohanty&author=SP.%20Kallurkar&journal=Int.%20J.%20Prod.%20Qual.%20Manag.&volume=7&issue=3&pages=263-286&publication_year=2011) (http://scholar.google.com/scholar_lookup?title=Service%20quality%20modelling%20for%20life%20insurance%20business%20using%20neural%20networks&author=A.%20Prakash&author=RP.%20Mohanty&author=SP.%20Kallurkar&journal=Int.%20J.%20Prod.%20Qual.%20Manag.&volume=7&issue=3&pages=263-286&publication_year=2011)
68. Grönroos, C.: *Strategic Management and Marketing in the Service Sector*. Swedish School of Economics and Business Administration, Helsingfors (1982)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Strategic%20Management%20and%20Marketing%20in%20the%20Service%20Sector&author=C.%20Gr%C3%B6nroos&publication_year=1982) (http://scholar.google.com/scholar_lookup?title=Strategic%20Management%20and%20Marketing%20in%20the%20Service%20Sector&author=C.%20Gr%C3%B6nroos&publication_year=1982)
69. Akter, S., Hani, U., Upal, M.: Service quality perception and satisfaction: a study in suburban public hospitals in Bangladesh. *Int. J. Serv. Res.* February (Special Issue), 125–145 (2008)
[Google Scholar](https://scholar.google.com/scholar?q=Akter%2C%20S.%2C%20Hani%2C%20U.%2C%20Upal%2C%20M.%3A%20Service%20quality%20perception%20and%20satisfaction%3A%20a%20study%20i) (<https://scholar.google.com/scholar?q=Akter%2C%20S.%2C%20Hani%2C%20U.%2C%20Upal%2C%20M.%3A%20Service%20quality%20perception%20and%20satisfaction%3A%20a%20study%20i>)

n%20suburban%20public%20hospitals%20in%20Bangladesh.%20Int.%20J.%20Serv.%20Res.%20February%20%28Special%20Issue%29%2C%20125%E2%80%93145%20%282008%29)

70. Jager, D.J., Plooy, D.T.: Are public hospitals responding to tangible and reliable service related needs of patients in the new South Africa? *J. Manag. Policy Pract.* **12**(2), 105–119 (2011)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Are%20public%20hospitals%20responding%20to%20tangible%20and%20reliable%20service%20related%20needs%20of%20patients%20in%20the%20new%20South%20Africa%3F&author=DJ.%20Jager&author=DT.%20Plooy&journal=J.%20Manag.%20Policy%20Pract.&volume=12&issue=2&pages=105-119&publication_year=2011) (http://scholar.google.com/scholar_lookup?title=Are%20public%20hospitals%20responding%20to%20tangible%20and%20reliable%20service%20related%20needs%20of%20patients%20in%20the%20new%20South%20Africa%3F&author=DJ.%20Jager&author=DT.%20Plooy&journal=J.%20Manag.%20Policy%20Pract.&volume=12&issue=2&pages=105-119&publication_year=2011)
71. Kuo, H.P.: Fuzzy comprehensive evaluation applied in the performance assessment of service quality of insurance companies in Taiwan. *J. Am. Acad. Bus.* **16**(1), 84–92 (2010)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Fuzzy%20comprehensive%20evaluation%20applied%20in%20the%20performance%20assessment%20of%20service%20quality%20of%20insurance%20companies%20in%20Taiwan&author=HP.%20Kuo&journal=J.%20Am.%20Acad.%20Bus.&volume=16&issue=1&pages=84-92&publication_year=2010) (http://scholar.google.com/scholar_lookup?title=Fuzzy%20comprehensive%20evaluation%20applied%20in%20the%20performance%20assessment%20of%20service%20quality%20of%20insurance%20companies%20in%20Taiwan&author=HP.%20Kuo&journal=J.%20Am.%20Acad.%20Bus.&volume=16&issue=1&pages=84-92&publication_year=2010)
72. Priporas, C.V., Laspa, C., Kamenidou, I.: Patient satisfaction measurement for in hospital services: a pilot study in Greece. *J. Med. Mark.* **8**(4), 325–340 (2008)
[CrossRef](https://doi.org/10.1057/jmm.2008.21) (<https://doi.org/10.1057/jmm.2008.21>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Patient%20satisfaction%20measurement%20for%20in%20hospital%20services%3A%20a%20pilot%20study%20in%20Greece&author=CV.%20Priporas&author=C.%20Laspa&author=I.%20Kamenidou&journal=J.%20Med.%20Mark.&volume=8&issue=4&pages=325-340&publication_year=2008) (http://scholar.google.com/scholar_lookup?title=Patient%20satisfaction%20measurement%20for%20in%20hospital%20services%3A%20a%20pilot%20study%20in%20Greece&author=CV.%20Priporas&author=C.%20Laspa&author=I.%20Kamenidou&journal=J.%20Med.%20Mark.&volume=8&issue=4&pages=325-340&publication_year=2008)
73. Sohail, M.: Service quality in hospitals, more favourable than you might think. *Manag. Serv. Qual.* **13**(2), 197–206 (2003)
[CrossRef](https://doi.org/10.1108/09604520310476463) (<https://doi.org/10.1108/09604520310476463>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Service%20quality%20in%20hospitals%2C%20more%20favourable%20than%20you%20might%20think&author=M.%20Sohail&journal=Manag.%20Serv.%20Qual.&volume=13&issue=2&pages=197-206&publication_year=2003) (http://scholar.google.com/scholar_lookup?title=Service%20quality%20in%20hospitals%2C%20more%20favourable%20than%20you%20might%20think&author=M.%20Sohail&journal=Manag.%20Serv.%20Qual.&volume=13&issue=2&pages=197-206&publication_year=2003)
74. Sajid, M.S., Baig, M.K.: Quality of health care, an absolute necessity for public satisfaction. *Int. J. Health Care Qual. Assur.* **20**(6), 545–548 (2007)
[CrossRef](https://doi.org/10.1108/09526860710819477) (<https://doi.org/10.1108/09526860710819477>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Quality%20of%20health%20care%2C%20an%20absolute%20necessity%20for%20public%20satisfaction&author=MS.%20Sajid&author=MK.%20Baig&journal=Int.%20J.%20Health%20Care%20Qual.%20Assur.&volume=20&issue=6&pages=545-548&publication_year=2007) (http://scholar.google.com/scholar_lookup?title=Quality%20of%20health%20care%2C%20an%20absolute%20necessity%20for%20public%20satisfaction&author=MS.%20Sajid&author=MK.%20Baig&journal=Int.%20J.%20Health%20Care%20Qual.%20Assur.&volume=20&issue=6&pages=545-548&publication_year=2007)
75. Jabnoun, N., Chacker, M.: Comparing the quality of private and public hospitals. *Manag. Serv. Qual.* **13**(4), 290–299 (2003)
[CrossRef](https://doi.org/10.1108/09604520310484707) (<https://doi.org/10.1108/09604520310484707>)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Comparing%20the%20quality%20of%20private%20and%20public%20hosp) (http://scholar.google.com/scholar_lookup?title=Comparing%20the%20quality%20of%20private%20and%20public%20hosp)

itals&author=N.%20Jabnoun&author=M.%20Chacker&journal=Manag.%20Serv.%20Qual.&volume=13&issue=4&pages=290-299&publication_year=2003)

76. Boshoff, C., Gray, B.: The relationships between service quality, customer satisfaction and buying intentions in the private hospital industry. *South Afr. J. Bus. Manag.* **35**(4), 27–38 (2004)
[CrossRef](https://doi.org/10.4102/sajbm.v35i4.666) (https://doi.org/10.4102/sajbm.v35i4.666)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=The%20relationships%20between%20service%20quality%2C%20customer%20satisfaction%20and%20buying%20intentions%20in%20the%20private%20hospital%20industry&author=C.%20Boshoff&author=B.%20Gray&journal=South%20Afr.%20J.%20Bus.%20Manag.&volume=35&issue=4&pages=27-38&publication_year=2004) (http://scholar.google.com/scholar_lookup?title=The%20relationships%20between%20service%20quality%2C%20customer%20satisfaction%20and%20buying%20intentions%20in%20the%20private%20hospital%20industry&author=C.%20Boshoff&author=B.%20Gray&journal=South%20Afr.%20J.%20Bus.%20Manag.&volume=35&issue=4&pages=27-38&publication_year=2004)
77. Ramsaran-Fowdar, R.R.: The relative importance of service dimensions in a healthcare setting. *Int. J. Health Care Qual. Assur.* **21**(1), 104–124 (2008)
[CrossRef](https://doi.org/10.1108/09526860810841192) (https://doi.org/10.1108/09526860810841192)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=The%20relative%20importance%20of%20service%20dimensions%20in%20a%20healthcare%20setting&author=RR.%20Ramsaran-Fowdar&journal=Int.%20J.%20Health%20Care%20Qual.%20Assur.&volume=21&issue=1&pages=104-124&publication_year=2008) (http://scholar.google.com/scholar_lookup?title=The%20relative%20importance%20of%20service%20dimensions%20in%20a%20healthcare%20setting&author=RR.%20Ramsaran-Fowdar&journal=Int.%20J.%20Health%20Care%20Qual.%20Assur.&volume=21&issue=1&pages=104-124&publication_year=2008)
78. Padma, P., Rajendran, C., Sai, L.P.: A conceptual framework of service quality in healthcare perspectives of Indian patients and their attendants. *Benchmark. Int. J.* **16**(2), 157–191 (2009)
[CrossRef](https://doi.org/10.1108/14635770910948213) (https://doi.org/10.1108/14635770910948213)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20conceptual%20framework%20of%20service%20quality%20in%20healthcare%20perspectives%20of%20Indian%20patients%20and%20their%20attendants&author=P.%20Padma&author=C.%20Rajendran&author=LP.%20Sai&journal=Benchmark.%20Int.%20J.&volume=16&issue=2&pages=157-191&publication_year=2009) (http://scholar.google.com/scholar_lookup?title=A%20conceptual%20framework%20of%20service%20quality%20in%20healthcare%20perspectives%20of%20Indian%20patients%20and%20their%20attendants&author=P.%20Padma&author=C.%20Rajendran&author=LP.%20Sai&journal=Benchmark.%20Int.%20J.&volume=16&issue=2&pages=157-191&publication_year=2009)
79. Aagja, J.P., Garg, R.: Measuring perceived service quality for public hospitals (PubHosQual) in the Indian context. *Int. J. Pharm. Healthc. Mark.* **4**(1), 60–83 (2010)
[CrossRef](https://doi.org/10.1108/17506121011036033) (https://doi.org/10.1108/17506121011036033)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Measuring%20perceived%20service%20quality%20for%20public%20hospitals%20%28PubHosQual%29%20in%20the%20Indian%20context&author=JP.%20Aagja&author=R.%20Garg&journal=Int.%20J.%20Pharm.%20Healthc.%20Mark.&volume=4&issue=1&pages=60-83&publication_year=2010) (http://scholar.google.com/scholar_lookup?title=Measuring%20perceived%20service%20quality%20for%20public%20hospitals%20%28PubHosQual%29%20in%20the%20Indian%20context&author=JP.%20Aagja&author=R.%20Garg&journal=Int.%20J.%20Pharm.%20Healthc.%20Mark.&volume=4&issue=1&pages=60-83&publication_year=2010)
80. Ladhari, R.: Alternative measure of service quality: a review. *J. Manag. Serv. Qual.* **18**(1), 65–86 (2008)
[CrossRef](https://doi.org/10.1108/09604520810842849) (https://doi.org/10.1108/09604520810842849)
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Alternative%20measure%20of%20service%20quality%3A%20a%20review&author=R.%20Ladhari&journal=J.%20Manag.%20Serv.%20Qual.&volume=18&issue=1&pages=65-86&publication_year=2008) (http://scholar.google.com/scholar_lookup?title=Alternative%20measure%20of%20service%20quality%3A%20a%20review&author=R.%20Ladhari&journal=J.%20Manag.%20Serv.%20Qual.&volume=18&issue=1&pages=65-86&publication_year=2008)
81. Chen, M.F., Tzeng, G.H., Tang, T.: Fuzzy MCDM approach for evaluation of expatriate assignments. *Int. J. Inf. Technol. Decis. Mak.* **4**(2), 277–296 (2005)

[CrossRef](https://doi.org/10.1142/S0219622005001520) (https://doi.org/10.1142/S0219622005001520)

[Google Scholar](http://scholar.google.com/scholar_lookup?title=Fuzzy%20MCDM%20approach%20for%20evaluation%20of%20expatriate%20assignments&author=MF.%20Chen&author=GH.%20Tzeng&author=T.%20Tang&journal=Int.%20J.%20Inf.%20Technol.%20Decis.%20Mak.&volume=4&issue=2&pages=277-296&publication_year=2005) (http://scholar.google.com/scholar_lookup?

title=Fuzzy%20MCDM%20approach%20for%20evaluation%20of%20expatriate%20assignments&author=MF.%20Chen&author=GH.%20Tzeng&author=T.%20Tang&journal=Int.%20J.%20Inf.%20Technol.%20Decis.%20Mak.&volume=4&issue=2&pages=277-296&publication_year=2005)

82. Zadeh, L.A.: The concept of a linguistic variable and its application to approximate reasoning: parts 1, 2 and 3. *Inf. Sci.* **8**, 199–249 (1975)

[zbMATH](http://www.emis.de/MATH-item?0397.68071) (http://www.emis.de/MATH-item?0397.68071)

[CrossRef](https://doi.org/10.1016/0020-0255(75)90036-5) (https://doi.org/10.1016/0020-0255(75)90036-5)

[Google Scholar](http://scholar.google.com/scholar_lookup?title=The%20concept%20of%20a%20linguistic%20variable%20and%20its%20application%20to%20approximate%20reasoning%3A%20parts%201%2C%202%20and%203&author=LA.%20Zadeh&journal=Inf.%20Sci.&volume=8&pages=199-249&publication_year=1975) (http://scholar.google.com/scholar_lookup?

title=The%20concept%20of%20a%20linguistic%20variable%20and%20its%20application%20to%20approximate%20reasoning%3A%20parts%201%2C%202%20and%203&author=LA.%20Zadeh&journal=Inf.%20Sci.&volume=8&pages=199-249&publication_year=1975)

83. Sinimole, K.R.: Performance evaluation of the hospital services—a fuzzy analytic hierarchy process model. *Int. J. Prod. Qual. Manag.* **101**, 112–130 (2012)

[Google Scholar](http://scholar.google.com/scholar_lookup?title=Performance%20evaluation%20of%20the%20hospital%20services%E2%80%93a%20fuzzy%20analytic%20hierarchy%20process%20model&author=KR.%20Sinimole&journal=Int.%20J.%20Prod.%20Qual.%20Manag.&volume=101&page=s=112-130&publication_year=2012) (http://scholar.google.com/scholar_lookup?

title=Performance%20evaluation%20of%20the%20hospital%20services%E2%80%93a%20fuzzy%20analytic%20hierarchy%20process%20model&author=KR.%20Sinimole&journal=Int.%20J.%20Prod.%20Qual.%20Manag.&volume=101&page=s=112-130&publication_year=2012)

84. Saaty, T.L.: *Multicriteria Decision Making: The Analytic Hierarchy Process*. RWS Publications, Pittsburgh (1990)

[zbMATH](http://www.emis.de/MATH-item?0707.90002) (http://www.emis.de/MATH-item?0707.90002)

[Google Scholar](http://scholar.google.com/scholar_lookup?title=Multicriteria%20Decision%20Making%3A%20The%20Analytic%20Hierarchy%20Process&author=TL.%20Saaty&publication_year=1990) (http://scholar.google.com/scholar_lookup?

title=Multicriteria%20Decision%20Making%3A%20The%20Analytic%20Hierarchy%20Process&author=TL.%20Saaty&publication_year=1990)

85. Davis, M.A.P.: A multi-criteria decision model application for managing group decisions. *J. Oper. Res. Soc.* **45**(1), 47–58 (1994)

[MathSciNet](http://www.ams.org/mathscinet-getitem?mr=1271858) (http://www.ams.org/mathscinet-getitem?mr=1271858)

[CrossRef](https://doi.org/10.1057/jors.1994.6) (https://doi.org/10.1057/jors.1994.6)

[Google Scholar](http://scholar.google.com/scholar_lookup?title=A%20multi-criteria%20decision%20model%20application%20for%20managing%20group%20decisions&author=MAP.%20Davis&journal=J.%20Oper.%20Res.%20Soc.&volume=45&issue=1&pages=47-58&publication_year=1994) (http://scholar.google.com/scholar_lookup?title=A%20multi-criteria%20decision%20model%20application%20for%20managing%20group%20decisions&author=MAP.%20Davis&journal=J.%20Oper.%20Res.%20Soc.&volume=45&issue=1&pages=47-58&publication_year=1994)

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